

***Bosara* Walker: revisional notes on the *Bosara refusaria* group of species (Geometridae, Larentiinae)**

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Abstract Seven species belonging to a distinct group within the genus *Bosara* Walker are considered and illustrated. Four are described as new. The taxonomic placement of the group is briefly commented upon. Records of *Gymnoscelis expedita* Prout from Japan are based on misidentification.

Key words *Bosara kadooriensis* sp. n., *Bosara maior* sp. n., *Bosara agassizi* sp. n., *Bosara torquibursa* sp. n., *Bosara maculilinea* (Warren), comb. n., *Gymnoscelis expedita* Prout, taxonomy.

Introduction

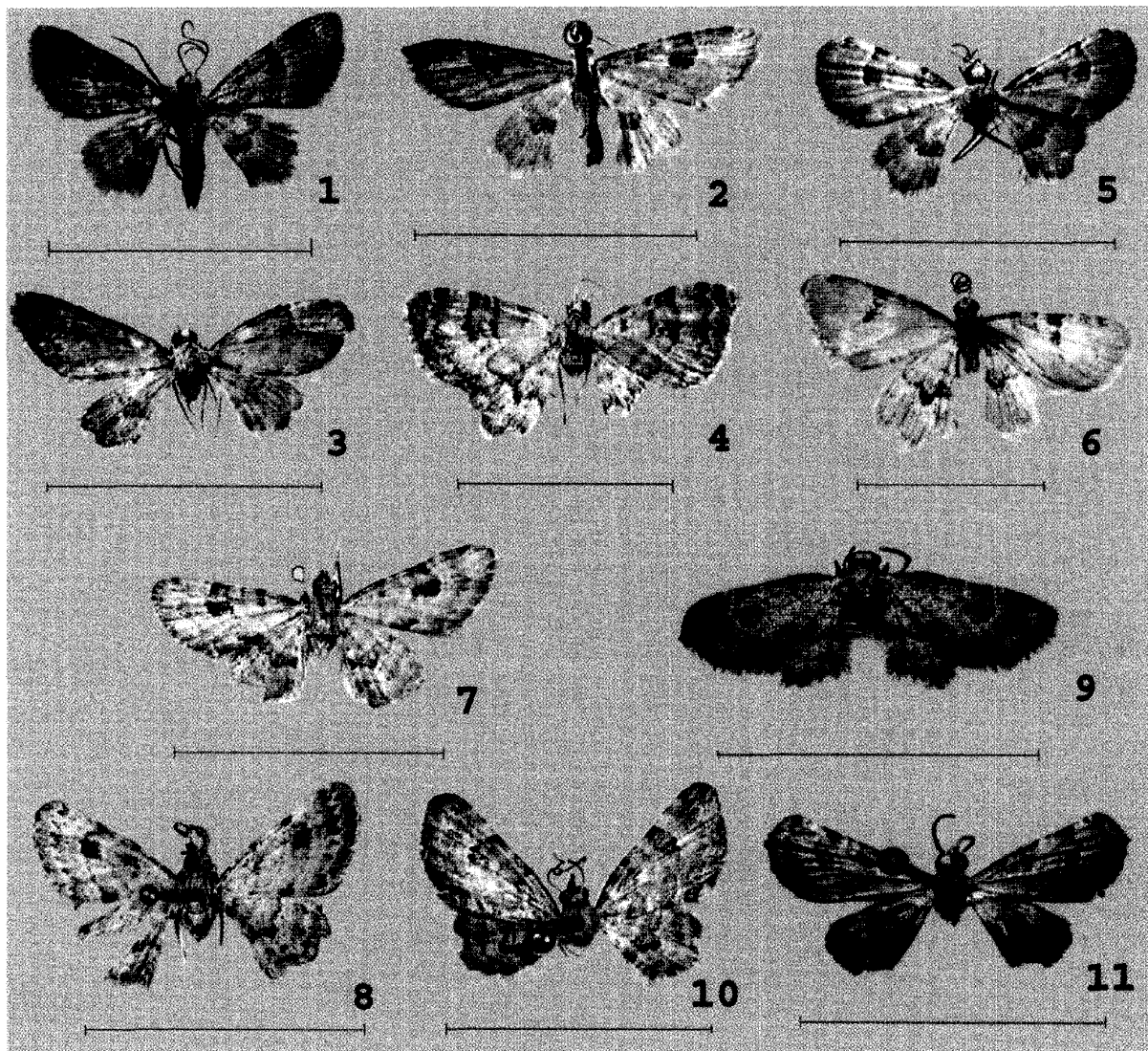
Holloway (1997) resurrected the genus *Bosara* Walker 1866 (type species *dilatata* Walker, 1866) to include a group of small species from the old broad concept of *Chloroclystis*. One of the species he included in this was *Acidalia refusaria* Walker 1861: in his taxonomic notes under this species he pointed to the existence of a small group of related species sharing an almost identical facies. The purpose of this paper, which arose originally out of work on the Hong Kong fauna, is to provide comparative information on this group, and to describe four new species belonging to it.

The insects are all extremely small (forewing length about 6 mm), and have a brown to grey ground colour on fore and hind wings. They are characterized by a pale postmedial line on the forewing, only moderately angled towards the costa, bounded basally by a dark band usually extending only across the anterior half of the wing and terminating at the faint, pale median line. The effect is of a regular dark median fascia stretching across the anterior half of the wing. The postmedial continues on the hindwing as a faint, slightly undulating line bordered narrowly on the basal side with dark brown.

The genitalia of the five known males of species in the group share several characteristics. The uncus is almost identical, of moderate length, and not partially covered by the tegumen, as in many other *Bosara*. The distal halves of the valves are narrow and parallel-sided, while the sacculus is widened and expanded apically to a point, sharper and more marked in *B. minima* than in other species. The saccus is rather square, with two small coremata at the base. The aedeagus is long and narrow, with a single cornutus, absent in *kadooriensis*. The octavals are quite well sclerotised, with two horn-like projections.

The female genitalia, figured below, are diverse and would not on their own suggest a close relationship across the whole group, although three of the four females from New Guinea are closely similar. However, the near identical facies and similarities in all the known male genitalia point clearly to a natural grouping.

All type and other material detailed below is preserved in the collection of the Natural History Museum, London.



Figs 1-11. Adults of *Bosara refusaria* group and *Glaucoclystis expedita*. 1. *B. refusaria*. 2. *B. minima*. 3. *B. kadooriensis* sp. nov. (holotype). 4. *B. kadooriensis* sp. nov., ? spring form. 5. *B. maior* sp. nov. (holotype). 6. *Glaucoclystis expedita* (holotype). 7. *B. agassizi* sp. nov. (holotype). 8. *B. maculilinea* (holotype). 9. ?*B. agassizi* sp. nov. (male). 10. *B. torquibursa* sp. nov. (holotype). 11. ?*B. torquibursa* sp. nov. (male). Scale bars=10 mm.

Abbreviation. BMNH: The Natural History Museum, London.

The group, whose members are only safely distinguishable one from another by examination of the genitalia, consists of the following:

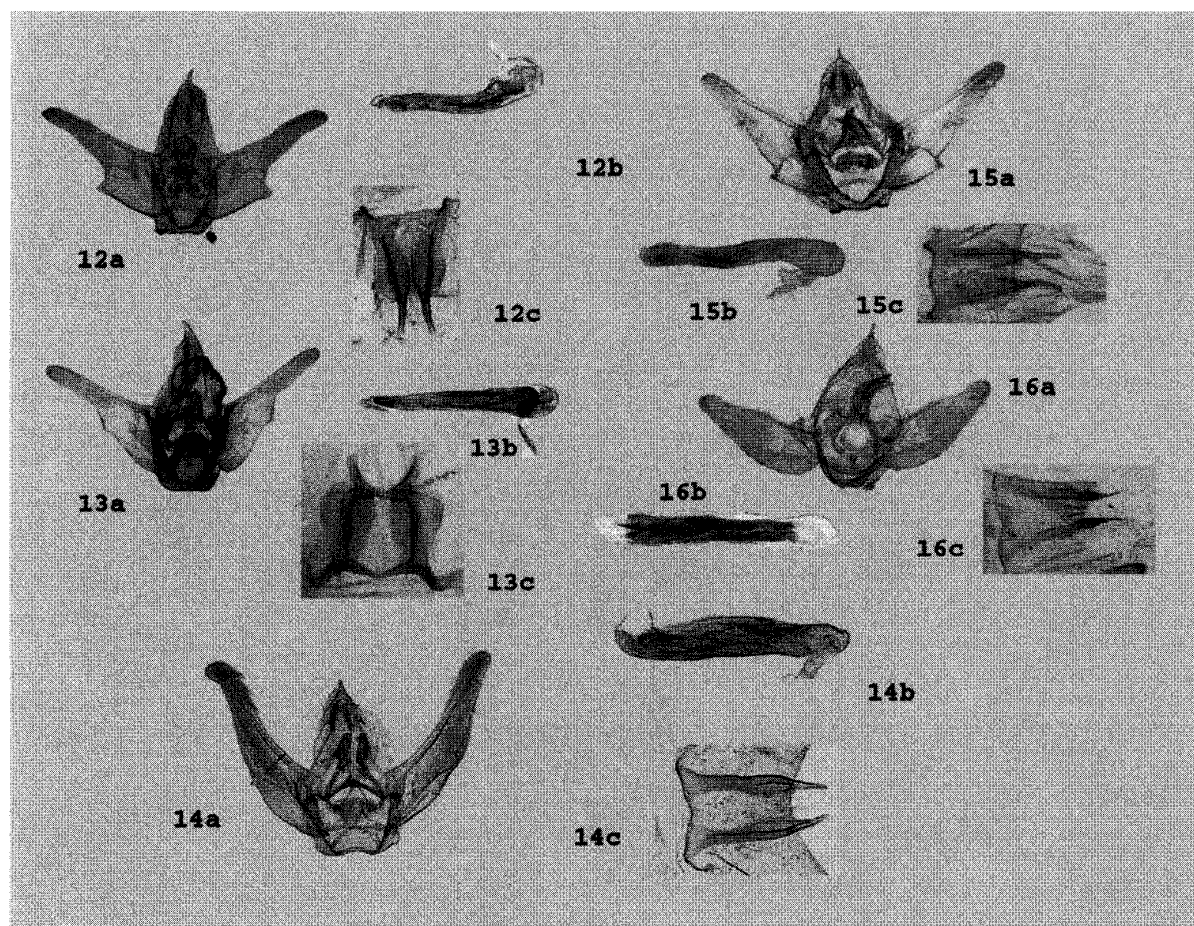
Bosara refusaria (Walker, 1861) (Fig. 1)

Acidalia refusaria Walker, 1861, *List Specimens lepid. Insects Colln Br. Mus.* **23**: 767.

Bosara refusaria: Holloway, 1997, *Malay. Nat. J.* **51**: 159, pl. 11, fig. 38, figs 470, 477.

Bosara refusaria: Parsons *et al.*, 1999, in Scoble (Ed.), *Geometrid Moths World* **1**: 91.

Diagnosis. Male genitalia (Figs 13a-c): pointed apex of sacculus only slightly protruding from edge. Octavals resembling a square box, with two short horns at apex. Female



Figs 12-16. Male genitalia of *Bosara refusaria* group. 12. *B. minima*. 13. *B. refusaria*. 14. *B. kadooriensis* sp. nov. 15. ?*B. agassizi* sp. nov. 16. ?*B. torquibursa* sp. nov. (a: valves; b: aedeagus; c: 8th sternite).

genitalia (Fig. 18): posterior part of bursa strongly sclerotised, with two distinct rows of teeth; bulbous lower part of bursa unspined; scroll-like structure on anterior edge of 7th sternite (not on the lamella antevaginalis, as stated in Holloway (1997)).

Range. Peninsular Malaysia, Borneo, Bali, Philippines.

Material examined. 1 ♀, Malaysia, West Pahang, 200 ft, 11-29. xi. 1981, coll. K. R. Tuck, BM 1981-549, BM Geometrid slide no 21457; 1 ♀, Malaysia, Kuala Lumpur, 21. iv. 1931, H. M. Pendlebury, BM Geometrid slide no 21482; 1 ♀, Borneo, Sabah, BM Geometrid slide no 18943; 1 ♂, Bali, BM Geometrid slide no 18985; 2 ♀, Bali, BM Geometrid slide 19084, and Mindanao, BM Geometrid slide no 19085. Type material not seen (but examined by Holloway in preparation of his work cited above).

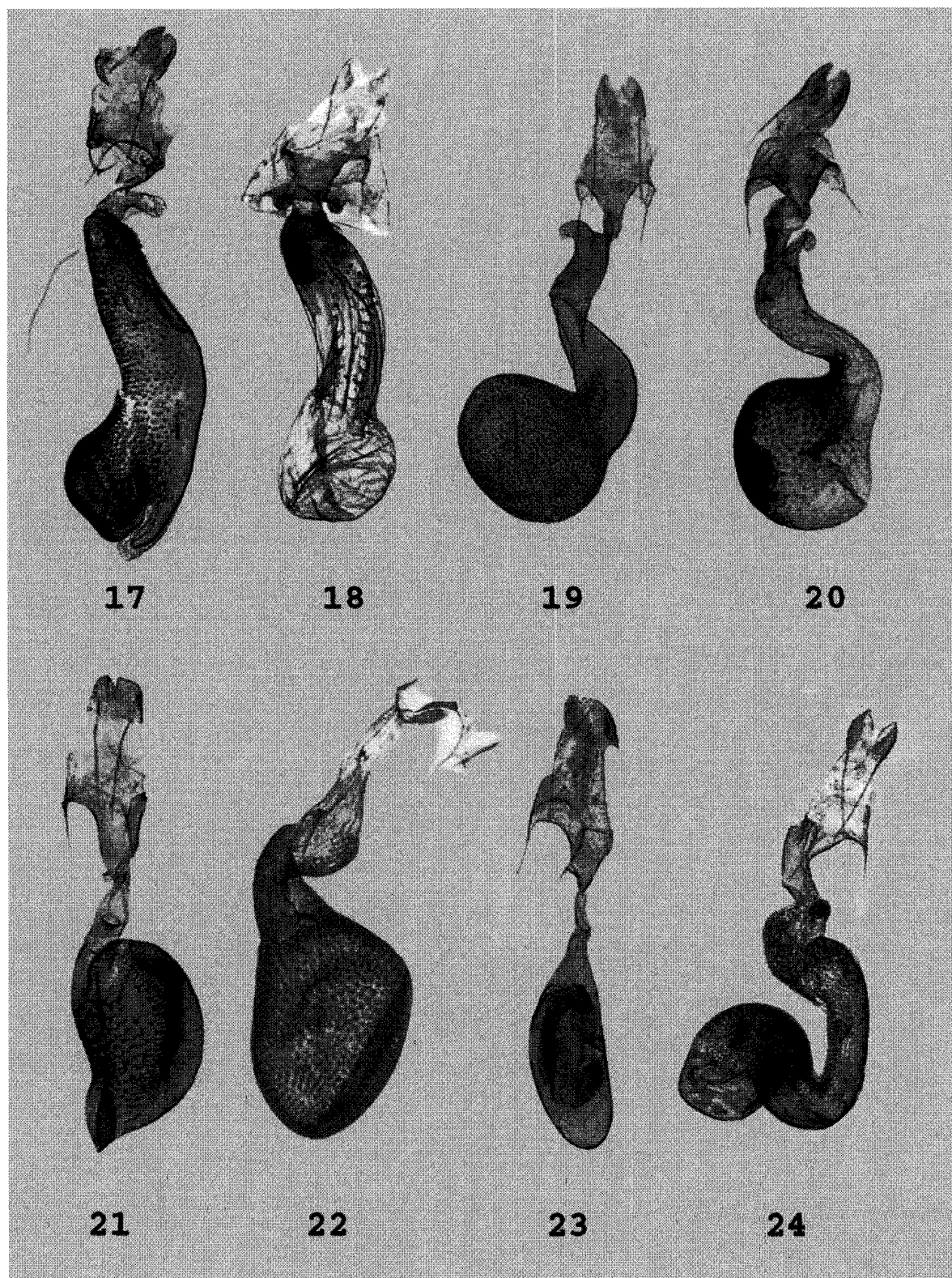
Bosara minima (Warren, 1897) (Fig. 2)

Chloroclystis minima Warren, 1897, *Novit. zool.* 4: 227.

Bosara minima: Holloway, 1997, *Malay. Nat. J.* 51: 160.

Bosara minima: Parsons *et al.*, 1999, in Scoble (Ed.), *Geometrid Moths World* 1: 91.

Diagnosis. Male genitalia (Figs 12a-c): pointed apex of sacculus protruding well beyond



Figs 17-24. Female genitalia of *Bosara refusaria* group and *Glaucoclystis expedita*. 17. *B. maior*. 18. *B. refusaria*. 19. *B. minima*. 20. *B. agassizi* sp. nov. (holotype). 21. *B. kadooriensis* sp. nov. (holotype). 22. *Glaucoclystis expedita*. 23. *B. maculilinea* (holotype). 24. *B. torquibursa* sp. nov. (holotype).

edge of sacculus. Octavals long and outward curving, not joined at distal end of eighth sternite. Female genitalia (Fig. 19): lacking teeth in sclerotised posterior part of bursa. Anterior part of bursa a lightly spined globe, much wider than posterior part.

Range. Sulawesi, Queensland, New Guinea, Bismarcks.

Material examined. Holotype ♀ (abdomen missing), Australia, nr Cairns; 2 ♂, Rossel Island, BM Geometrid slide no 19080, and Sulawesi, BM Geometrid slide no 21232; 2 ♀, New Hannover, BM Geometrid slide no 19076, and Sulawesi, BM Geometrid slide no 19081.

***Bosara kadooriensis* sp. nov.** (Figs 3, 4)

Gymnoscelis expedita Prout, 1958: Inoue, 1986, *Tinea* **12**: 65, fig. 22B, figs 23A–D; Inoue, 1992, in Heppner and Inoue (Eds), *Lepid. Taiwan* **1** (2): 129. Misidentification.

Description. The normal form (Fig. 3) shares the typical facies of the group as described above. Two specimens (Fig. 4) with identical genitalia show considerably heavier markings, including a pale zigzag subterminal line proceeding from a dark mark on the costa. These are the two specimens cited below which were collected in March, as opposed to the others from this latitude, which were collected from June to August. The former may represent an early spring form. Male genitalia (Figs 14a–c): close to those of *refusaria*, but with width of sacculus reduced and its apex a narrow tooth. 8th sternite two stout bars ending in a club shape. Female genitalia (Fig. 21): neck of bursa narrow, unsclerotised, entering posterior part of bursa well below its apex. Anterior part of bursa with sparse medium spines below neck of bursa, and dense small spines on opposite side.

Holotype. ♀, Hong Kong, New Territories, Kadoorie Farm Botanic Gardens, 24. xi. 1999, leg. R. Kendrick, BM Geometrid slide no 21362. Paratypes. 1 ♀, Japan, Amami-Oshima, 12. iii. 1975, leg. S. Hashimoto; 1 ♀, Japan, Funcha-toge, 5. ix. 1983, leg. K. Okushi; 1 ♀, Japan, Okinawa, Yona, 3. iii. 1981, leg. K. Deguchi; 1 ♀, Japan, Ishigaki-jima, Mt Banna, 1–6. viii. 1981, leg. M. Owada. 1 ♀, Taiwan, Nantou County, Wushe, 15. vii. 1964, 2 ♀, Taiwan, Chiai County, Fenchihu, 12–13. vii. 1964, leg. H. Inoue; 1 ♂, *ditto*, 23–24. vi. 1973, leg. M. Owada; 1 ♀, Taiwan, Kaohsiung County, Liukei, 350 m, 30. vii. 1987, leg. R. Sato (all paratypes in Inoue collection, BMNH).

Other material examined. 1 ♀, Malaysia, Penang Hill, 22. iii. 1969, leg. I. Fujiyama; 1 ♂ 3 ♀, Sri Lanka, Maskeliya, iii, v and xii, no further dates.

Range. Japan (Ryukyus), Taiwan, Hong Kong, doubtless extending on to the South Chinese mainland, Peninsular Malaysia, Sri Lanka (where it is sympatric with *B. maior* below).

Remarks. With the exception of the holotype, and the last mentioned paratype, these specimens were published in Inoue (1986) as *Gymnoscelis expedita* Prout. Close comparison with the holotype of the latter in the BMNH (Fig. 6) shows that they do not belong to this species. The holotype of *expedita* has lost its abdomen, but has longer palps than the present species, a quite different wing scale texture, and a different shape of dark bands on the wings, much more closely resembling *Glaucochystis acygonia* Swinhoe. I recently discovered a second specimen of *expedita* in the accessions section of the BMNH collection: it is from the type locality (Selangor, Peninsular Malaysia), derives, like the holotype, from the Pendlebury collection, and bears a label in Prout's handwriting reading "*Gymnoscelis expedita* paratype female". No paratype was designated in Prout (1958), although the label makes it plain that

Prout had intended to do so. The paper was published after Prout's death, having been assembled from Prout's notes by D. S. Fletcher. It appears that the paratype was omitted, either because the notes did not refer to it, or perhaps more likely, because the specimen could not then be located. It has a gummed abdomen, but also bears a separate manuscript label reading "Abdomen guaranteed L. B. P." (*i. e.* L. B. Prout). The genitalia, when dissected (Fig. 22, BM Geometrid slide no 21468), proved to be a typical female eupitheciine, and it seems safe to assume that they belong to this species. They do not resemble those of the present species. Holloway (1997) in fact placed *expedita* in *Glaucoclystis*.

One of the other female specimens listed by Inoue (1986), a female from Sun-Moon Lake, Nantou County, Taiwan, does not belong to the present species, but is probably a specimen of *Eriopithex ishigakiensis* Inoue.

***Bosara maior* sp. nov.** (Fig. 5)

Description. Shares the typical facies of the group as described above. Female genitalia (Fig. 17): bursa with an appendage at neck giving rise to ductus seminalis. Main part of bursa long, gradually expanding towards anterior end, spined in posterior two thirds on both sides, and in anterior part on one side only. Anterior third expands into densely spined membranous area, with short more sclerotised tubular appendage at one side. Easily distinguished from other members of the group by the lack of an abrupt transition from the posterior part of the bursa to a bulbous anterior section.

Male unknown.

Holotype. ♀, Sri Lanka, undated, Rothschild bequest BM 1939-1, BMNH Geometrid slide no 19089. Paratype. 1 ♀, Sri Lanka, undated, Rothschild bequest BM 1939-1, BMNH Geometrid slide no 21238.

Range. Sri Lanka.

***Bosara agassizi* sp. nov.** (Fig. 7)

Description. Indistinguishable in facies from the other members of the group described above. Female genitalia (Fig. 20): similar in pattern to those of *minima*, to which it is doubtless closely related, but posterior section of bursa membranous, lacking the strong sclerotisation of *minima*. Globular anterior part of bursa only half covered with small spines, while it is entirely covered in *minima*.

Genitalia of tentatively assigned male (Figs 15a-c): valves rather similar to *B. minima*, but sacculus expanded to a much smaller degree, with a blunt tooth-like projection at the apex. Aedeagus long and very narrow, with a stout medium sized cornutus. Octavals very similar to *minima*, but sternite 8 with a sinuous proximal margin.

Holotype. ♀, Papua New Guinea, Southern Highlands, Tari, 5,300 ft, 3. i. 1986, leg. D. J. L. Agassiz, BM Geometrid slide no 21385.

Other material examined. 1 ♂ (Fig. 9), Eastern Highlands, Goroka, 5,200 ft, 10-21. vii. 1974, coll. E. W. Classey, BM 1974-408, BM Geometrid slide no 21485.

Remarks. The male mentioned above is not designated as paratype, because of residual uncertainty as to whether or not it belongs with the female. Nevertheless, the likelihood is that it does, since it was collected at almost the same altitude at a location in the central

highlands some 250 km from the female, whereas the other New Guinea male detailed below comes from a lowland locality in the extreme south east of the island.

***Bosara maculilinea* (Warren, 1898), comb. nov. (Fig. 8)**

Pasiphilodes maculilinea Warren, 1898, *Novit. zool.* 5: 429.

Gymnoscelis maculilinea: Holloway, 1997, *Malay. Nat. J.* 51: 160.

Gymnoscelis pyrisous: Parsons *et al.*, 1999, in Scoble (Ed.), *Geometrid Moths World* 1: 418 (*part. nec* Prout, 1958)

Diagnosis. Very similar in facies to the other species of the group, but has in addition to the other markings a crenellate submarginal line. Female genitalia (Fig. 23) with smoothly curved antrum rather similar to that of *kadooriensis* sp. nov.: bursa pyriform, flimsy and unspined.

Range. Key Islands (New Guinea).

Material examined. Holotype ♀, Key Islands, xii. 1895, coll. H. Kuhn, BM Geometrid slide no 19075.

Taxonomic note. Holloway (1997) mentioned this species in his treatment of *refusaria*, with which it had long been treated as a synonym in the BMNH collection. He indicated that it was not conspecific with *refusaria*, but elected to leave it in *Gymnoscelis*, since only the unique holotype female was available, and the genitalia did not have a close relationship to either *refusaria* or *minima*. However they are quite close to *kadooriensis* sp. nov., especially in the shape of the antrum: I therefore rather tentatively transfer it to *Bosara*, as part of this group.

The placement of this species as a synonym of *G. pyrisous* Prout in Parsons *et al.* (1999) appears to be an editorial error. *G. maculilinea* had always been treated in the BMNH collection and index as a synonym of *refusaria* rather than this species, which it does not resemble, but the index cards of the two are consecutive, which probably led to the confusion.

***Bosara torquibursa* sp. nov. (Fig. 10)**

Description. Pattern very similar to other members of the group, but with a more yellow-brown cast to the ground colour, and a wider than normal pale fascia on the outer side of the medial brown band; a pale zigzag postmedial line on the forewing; hindwing with a brown postmedial. Female genitalia (Fig. 24): similar in pattern to *minima* and *agassizi*, but upper part of bursa much longer, more convolute, and extensively spined. Antrum expanded into a triangular shape, and strongly sclerotised.

Holotype. ♀, Goodenough Island (Papua New Guinea), 2,500–4,000 ft, iv. 1913, A. S. Meek, Rothschild bequest BM1939-1, BM Geometrid slide no 21489.

Range. Holotype from Goodenough Island, extending to the extreme South East of New Guinea if the male tentatively assigned below in fact belongs to the same species.

A further different male from New Guinea was discovered among the BMNH series of *B. minima*, and is illustrated at Fig. 10. The genitalia are illustrated at Figs 16a–c. The valves are more gradually tapering than other males of this group, with the sacculus and its tip showing as little more than a crease on the valve. The aedeagus is very long and narrow, with a long thin cornutus near the tip. The octavals are similar to those of *B. minima*, but

narrow to sharp apices rather than the spatulate tips of the latter species. The specimen is too worn to allow a direct comparison with the present species, but is here very tentatively associated with it, since the collection site is quite close to that of the holotype of the present species. Collection details are as follows: British New Guinea, Milne Bay, A. S. Meek, Rothschild bequest BM-1939-1, BM Geometrid slide no 21239.

Taxonomic placement of the group

The members of this group are not typical *Bosara*, lacking some of the features cited by Holloway as characteristic of that genus, e. g. sexual dimorphism with a bowing of the costa in the male, the doubly angled postmedial, and, in the male abdomen, the expanded tegumen covering the greater part of the uncus. However, they fit *Bosara* rather better than any other currently available genus. In the present state of knowledge of the smaller Asian eupitheciines, it would be premature to erect a new genus for this group. It therefore seems best to leave it in *Bosara* for the time being.

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摘 要

Bosara refusaria 種群 (シャクガ科, ナミシャク亜科) の再検討 (Anthony Galsworthy)

Holloway (1997) によって大属 *Chloroclystis* から分離された *Bosara* 属の, *refusaria* とその近縁種群の再検討を行った. この *refusaria* 種群には外観のよく似た 7 種が認められ, そのうち下記の 4 種は新種として記載した.

Bosara kadooriensis Galsworthy ヒトスジチビナミシヤク (日本, 台湾, 香港, マレー半島, スリランカ)

ヒトスジチビナミシヤクは Inoue (1986) によって *Gymnoscelis expedita* Prout として日本および台湾から記録されたが, 本報で標記の新種とした.

Bosara maior Galsworthy (スリランカ)

Bosara agassizi Galsworthy (パプアニューギニア)

Bosara torquibursa Galsworthy (パプアニューギニア)

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